Spectrogram Computation

The Torchaudio spectrogram uses an STFT with a 1024-point FFT, Hann window, 87.5% overlap, and power scaling, while the MNE version employs Morlet wavelets with frequency-dependent cycles

Torchaudio Spectrogram Configuration

The spectrogram is computed using torchaudio.transforms.Spectrogram with:

Hann window (window\_fn=torch.hann\_window)

Centered frames (center=True)

Reflection padding (pad\_mode='reflect')

One-sided spectrum (onesided=True)

No normalization (normalized=False)

Spectrogram Parameters

1. **FFT and Window Settings**:
   * N\_FFT = 1024: Number of FFT points (larger for better frequency resolution)
   * WIN\_LENGTH = 512: Window length in samples
   * HOP\_LENGTH = 64: Hop size between consecutive windows (87.5% overlap)
   * Resulting overlap: 87.5% (calculated as (1 - HOP\_LENGTH/WIN\_LENGTH)\*100)
2. **Power and Scaling**:
   * POWER = 2.0: Computes power spectrogram (magnitude squared)
   * Conversion to dB scale: 10 \* log10(spec + 1e-10)
3. **Visualization Parameters**:
   * CMAP = 'viridis': Colormap for spectrogram visualization

A close-up of a graph

AI-generated content may be incorrect.

MNE Spectrogram Configuration

n\_cycles = freqs / 2.0: Uses wavelet cycles that scale with frequency (more cycles for higher frequencies)

Computes time-frequency decomposition using Morlet wavelets

Uses Morlet wavelet transform (mne.time\_frequency.tfr\_morlet)

n\_cycles = freqs / 2.0: The number of wavelet cycles scales linearly with frequency

Colormap: 'viridis'

A close up of a screen

AI-generated content may be incorrect.

Comparison to FFT Approach

| **Characteristic** | **MNE Wavelet Version** | **Torchaudio FFT Version** |
| --- | --- | --- |
| **Transform Type** | Morlet Wavelet | Short-Time Fourier Transform (STFT) |
| **Resolution Control** | Cycles per frequency | Fixed N\_FFT/Win\_length |
| **Frequency Resolution** | Better at low frequencies | Uniform across spectrum |
| **Time Resolution** | Better at high frequencies | Uniform across spectrum |
| **Window Function** | Implicit Morlet wavelet | Explicit Hann window |
| **Overlap** | N/A (continuous) | 87.5% (HOP\_LENGTH=64) |